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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,881	11/21/2003	Yi-Lung Cheng	TS03-431	1465

8933 7590 10/26/2005

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EXAMINER

NGUYEN, THANH T

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 10/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/718,881

Applicant(s)

CHENG ET AL.

Examiner

Thanh T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 4-28 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1,2 and 4-23 is/are allowed.
- 6) ☒ Claim(s) 24,25,27 and 28 is/are rejected.
- 7) ☒ Claim(s) 26 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 8/9/05 have been fully considered but they are not persuasive.

Claim Objections

Claims 4, 12, 22 are objected to because of the following informalities:

In claim 4, line 1, replace "The method of claim 1" with "The method of claim 1".

In claims 12, 22, line 3, replace "Cl₁" with "Cl₂".

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 24-25, 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Islam et al. (U.S. Patent No. 6,174,810) in view of Wolf et al. (Silicon Processing for the VLSI ERA, vol. 1, pages 182-195, 551-555, 581-582).

Referring to figures 1-6, Islam et al. teaches a method of defining an opening in a stack of insulator layers on a semiconductor substrate, comprising the steps of:

Referring to figures 1-6, Islam et al. teaches a method of defining an opening in a stack of insulator layers on a semiconductor substrate, comprising the steps of:

providing a conductive region (38) on said semiconductor substrate (10);

forming a tri-layer insulator composite (40/41/42; silicon nitride/silicon oxynitride/oxide) on said conductive region and on portions of said semiconductor substrate (see figure 4);

forming an insulator layer (46, TEOS/BPSG, see col. 5, lines 43-47) on said tri-layer insulator composite;

forming an opening (52) in said insulator layer to expose a portion of a top surface of said tri-layer insulator composite (see figure 5); and

removing portion of said tri-layer insulator composite (52) exposed in said opening (see figure 6);

exposing a portion of a top surface of said conductive region (see figure 6).

Regarding to claim 25, the conductive region is a source/drain region in a semiconductor substrate, or a metal structure such as a metal interconnect structure (38, see figure 6).

Islam teaches forming a tri-layer insulator composite. However, the references does not teach forming the layer silicon rich-silicon oxide layer by using silane and oxygen in LPCVD

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process, silicon nitride layer by using PECVD or LPCVD process, silicon oxynitrides [SiO_xN_y(Hz)] by LPCVD or PECVD process and etching the layer by using dry etch, anisotropic RIE procedure.

Wolf teaches depositing a silicon nitride or doped silicon oxide (BPSG) layer, or silicon oxide using TEOS, and depositing silicon-rich oxide using silane or disilane and oxygen or nitrous oxide as reactant, silicon oxynitrides [SiO_xN_y(Hz)] by LPCVD or PECVD process (see table 4, pages 194-195, of Wolf). Wolf also teaches etching the silicon oxide layer and silicon nitride layer by using CF₄, CHF₃ (see page 581, table 5), vertically/directional etch called anisotropic etch (see pages 551-552).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to deposit a silicon nitride or doped silicon oxide (BPSG) layer, or silicon oxide using TEOS, and depositing silicon-rich oxide using silane or disilane and oxygen or nitrous oxide as reactant by LPCVD or PECVD process, etching the silicon oxide layer and silicon nitride layer by using CF₄, CHF₃ (see page 581, table 5), vertically/directional etch called anisotropic etch in process of Islam et al. as taught by Wolf et al. because depositing the layers by LPCVD or PECVD process would obtain uniform deposition as well as good step coverage and etching the layers by using CF₄ or CHF₃ would provide good selectivity and smaller loading effect.

The specific thickness range of claims 27 are considered to involve routine optimization while has been held to be within the level of ordinary skill in the art. As noted in In re Aller, the selection of reaction parameters such as temperature and concentration would have been obvious:

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Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art...such ranges are termed Acritical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.

In re Aller 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmscher* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Therefore, one of ordinary skill in the requisite art at the time the invention was made would have used any thickness range, refractive index, and time range suitable to the method in process of Islam et al. in order to optimize the process.

Allowable Subject Matter

Claims 1-2, 4-23 are allowed.

Claim 26 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The reason for allowance: none of the prior art alone or in combination teach the subset of forming tri-layer insulator layer is comprised of an underlying silicon rich silicon oxide layer, a hydro - silicon oxynitride (H₀xSiN) layer, and an overlying silicon nitride layer.

Response to Arguments

Applicant's arguments filed 8/9/05 have been fully considered but they are not persuasive.

Applicant contends that Islam does not teach the features of the conductive region on the semiconductor substrate and the insulator layer on the tri-layer insulator. In response to applicant that Islam clearly teaches the conductive region (38) on the semiconductor substrate (10) and the insulator layer (46) on the tri-layer insulator (40/41/42, see figure 4 and related text). Applicant contends that on means positioned above and in contact with. In response to applicant that on does means positioned above but it does not necessary in contact with.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).

A handwritten signature in black ink, appearing to read 'Thanh', with a long horizontal stroke extending to the right.

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN